

# **EXHIBIT 5**

# **Clickstream System - Proof Of Concept (POC) Project**

## **Test Plan**

**BELLSOUTH** Interactive Media Services

This document defines test procedures to study the impact of the Clickstream system on the BellSouth Interactive Television network.

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### **Revision History:**

1.00	9/19/96	5:00pm EST	TG	Proof of Concept test plan, initial release for review.
1.01	9/23/96	3:00pm EST	WB	<ul style="list-style-type: none"><li>• Revised previous test cases.</li><li>• Added new tests cases.</li><li>• Added Table of Contents</li></ul>

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## **1. Overview**

Clickstream Proof of Concept testing will include a number of tests to stress the BellSouth interactive TV network to better understand the amounts of bandwidths which can be used on an ongoing basis without impact to network elements or any customer services. The data paths used for the uploading and acknowledging of Clickstream data transfers are the same data paths used for session setup and tear down of all interactive services. As such, it will be of great importance to test Clickstream activities on the system while interactive services are being accessed and used. Great care will have to be taken to make empirical measurements on delays in accessing interactive services that the Clickstream system may introduce, and at what bandwidths services may become degraded.

Please read through all test procedures before beginning.

## 2. Test Procedures

### 2.1 Network Stress

#### 2.1.1 Test 1 : Network Test, Clickstream Bandwidth test only.

##### Overview:

The purpose of this test is to stress the network throughput. It will utilize 10 set top boxes each with a defined 10KB buffer. This allows each STB to attempt up to 80kbits of data each second. We will then increase the number of STBs uploading buffers each second to increase total aggregate throughput.

##### Setup:

- Load 10 set-tops with Clickstream code that will upload a 10KB buffer of Channel Up clicks.
- Use the Upload Controller to set the upload parameters on the STBs. For each STB all flags should be off initially. You can set the **UploadOnBufferFull** to start the test.

##### Test Procedures:

###### Iteration 1: 80Kbit/sec

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time	Number of NAKS	Number of Collisions
1	1	500	10	100	00:00:00		

###### CMC Errors:

###### Iteration 2: 240Kbit/sec

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time	Number of NAKS	Number of Collisions
1	1	500	5	100	00:00:00		
2	1	500	10	100	00:00:00		
3	1	500	15	100	00:00:00		

CMC Errors:

Iteration 3: 480Kbit/sec

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time	Number of NAKS	Number of Collisions
1	1	500	5	100	00:00:00		
2	1	500	10	100	00:00:00		
3	1	500	15	100	00:00:00		
4	1	500	20	100	00:00:00		
5	1	500	25	100	00:00:00		
6	1	500	30	100	00:00:00		

CMC Errors:

**Results:**

Note any erratic behavior of the CMC, and save the CMC logs for the entire test.

Note the number of collisions reported by each Set-Top as the bit rate is increased.

Note the number of NACKs sent on uploads as the bit rate is increased.

### 2.1.2 Test 2 : Network Test, Combination ITV and Clickstream behavior

#### Overview:

This test is designed to determine if buffer uploading impacts L2 boots and interactive TV sessions. For this test, we will use 5 STBs running the standard Surfer application and 5 running a debug version of the Clickstream kernel.

#### Setup:

- Load 5 set-tops with Clickstream "Dummy Buffer" test code.
- Other 5 set-tops have standard Surfer in ROM.

#### Test Procedures:

Launch 10 Level 2 boots and 10 ITV sessions to validate the time for each load.

Load	L2 Boot	ITV Session
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Average.		

Run the following:

Iteration 1: 80Kbit/sec

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time
1	1	500	10	100	00:00:00

Five Uploads:

Upload	Number of NAKS	Number of Collisions	L2 Boot	ITV Session
1				

2				
3				
4				
5				

CMC Errors:

Iteration 2: 240Kbit/sec

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time
1	1	500	10	100	00:00:00
2	1	500	15	100	00:00:00
3	1	500	20	100	00:00:00

Five Uploads:

Upload	Number of NAKS	Number of Collisions	L2 Boot	ITV Session
1				
2				
3				
4				
5				

CMC Errors:

Iteration 3: 480Kbit/sec

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time
1	1	500	10	100	00:00:00
2	1	500	15	100	00:00:00
3	1	500	20	100	00:00:00
4	1	500	25	100	00:00:00
5	1	500	30	100	00:00:00
6	1	500	5	100	00:00:00


Five Uploads:

Upload	Number of NAKS	Number of Collisions	L2 Boot	ITV Session
1				
2				
3				
4				
5				

CMC Errors:

### 2.1.3 Test 3 : Network Test, Combination ITV, L1 Pass Through and Clickstream behavior

#### Setup:

- Load 5 set-tops with Clickstream "Dummy Buffer" test code.
- Other 5 set-tops have standard Surfer in ROM.
- Start DBAC Trickle at current data rates run in the Field.
- Start normal SNMP management activity.

#### Test Procedures:

Repeat test # 2, but during set up turn on the DBAC trickle and SNMP management tasks which use level 1 pass-through. This will cause both an increase in the data rate through the CMC and a higher burden on the Stream Controller.

Repeat test procedures for test #2 as noted below.

#### Iteration 1: 80Kbit/sec

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time
1	1	500	10	100	00:00:00

#### Five Uploads:

Upload	Number of NAKS	Number of Collisions	L2 Boot	ITV Session
1				
2				
3				
4				
5				

#### CMC Errors:

#### Iteration 2: 240Kbit/sec

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time
1	1	500	10	100	00:00:00

2	1	500	15	100	00:00:00
3	1	500	20	100	00:00:00

Five Uploads:

Upload	Number of NAKS	Number of Collisions	L2 Boot	ITV Session
1				
2				
3				
4				
5				

CMC Errors:

Iteration 3: 480Kbit/sec

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time
1	1	500	10	100	00:00:00
2	1	500	15	100	00:00:00
3	1	500	20	100	00:00:00
4	1	500	25	100	00:00:00
5	1	500	30	100	00:00:00
6	1	500	5	100	00:00:00

Five Uploads:

Upload	Number of NAKS	Number of Collisions	L2 Boot	ITV Session
1				
2				
3				
4				
5				

CMC Errors:

**Results:**

Make note of any critical systems failures and under what circumstances.

Compare the average and standard deviation values of L2 boot launch and download times at each Clickstream upload bitrate.

Note any increases of NACKs or upload packet collisions when sessions are launched.

\*Note differences between test 2 and test 3 in average and standard deviation values of L2 boot launch and download times at each Clickstream upload bitrate. These differences can be attributed to the additional load of DBAC Trickle and SNMP management on the system.

## **2.2 Set-Top Stress**

### **2.2.1 Test 4: Set-Top Test: Application latencies during Clickstream**

**Setup:**

Load a single STB with "Dummy Buffer" Clickstream code.

Suppress uploading for the initial part of the test.

**Test Procedures:**

Use the Surfer application and get a feel for the channel change latencies between analog and between digital channels.

Press TV/ITV to launch a session. Measure the time it takes for the session to launch.

Reset the Set-Top and repeat launching a session 10 times. Note average and standard deviation numbers.

Use the Navigator application and get a feel for latencies in cursor movement and movement between screens.

These latencies will be very small (on the order of 50 to 300 ms) and impossible to measure empirically without software written to monitor them, but a feeling can be gathered by the tester with extended use of the applications.

Now, change Clickstream control parameters such that the Set-Top is continually uploading the "Dummy" Clickstream Buffer. Make sure that the uploads are occurring and acknowledgments are being received by the STB.

Use the Surfer application and get a feel for channel change latencies and other key press latencies. Make a note of any differences with Clickstream on and off.

With Clickstream uploads occurring, press TV/ITV to launch a session. Measure the time it takes for the session to launch.

Reset the Set-Top and repeat launching a session 10 times while the Clickstream kernel is uploading data. Note average and standard deviation numbers.

**Results:**

Note any serious problems, i.e. STB lockups, very long latencies in session launch, etc.

Note the session launch time differences with Clickstream transmitting and Clickstream not transmitting.

#### **2.2.2 Test 5: STB Duration Load.**

#### **Overview**

This test will run couple of STBs for 4 hours doing uploads every 5 to 10 minutes. The idea is to stress how the system works under continuous load of capturing clicks and uploading buffers.

**Setup:**

STBs	Cycle Time	Upload Duration	Inter Packet Delay	Last Packet Delay	Initial Cycle Time
1	600	60000	10	5000	00:00:00
2	300	60000	10	5000	00:00:15

- Start a Virtual Remote Control for each STB.

**Test Procedures:**

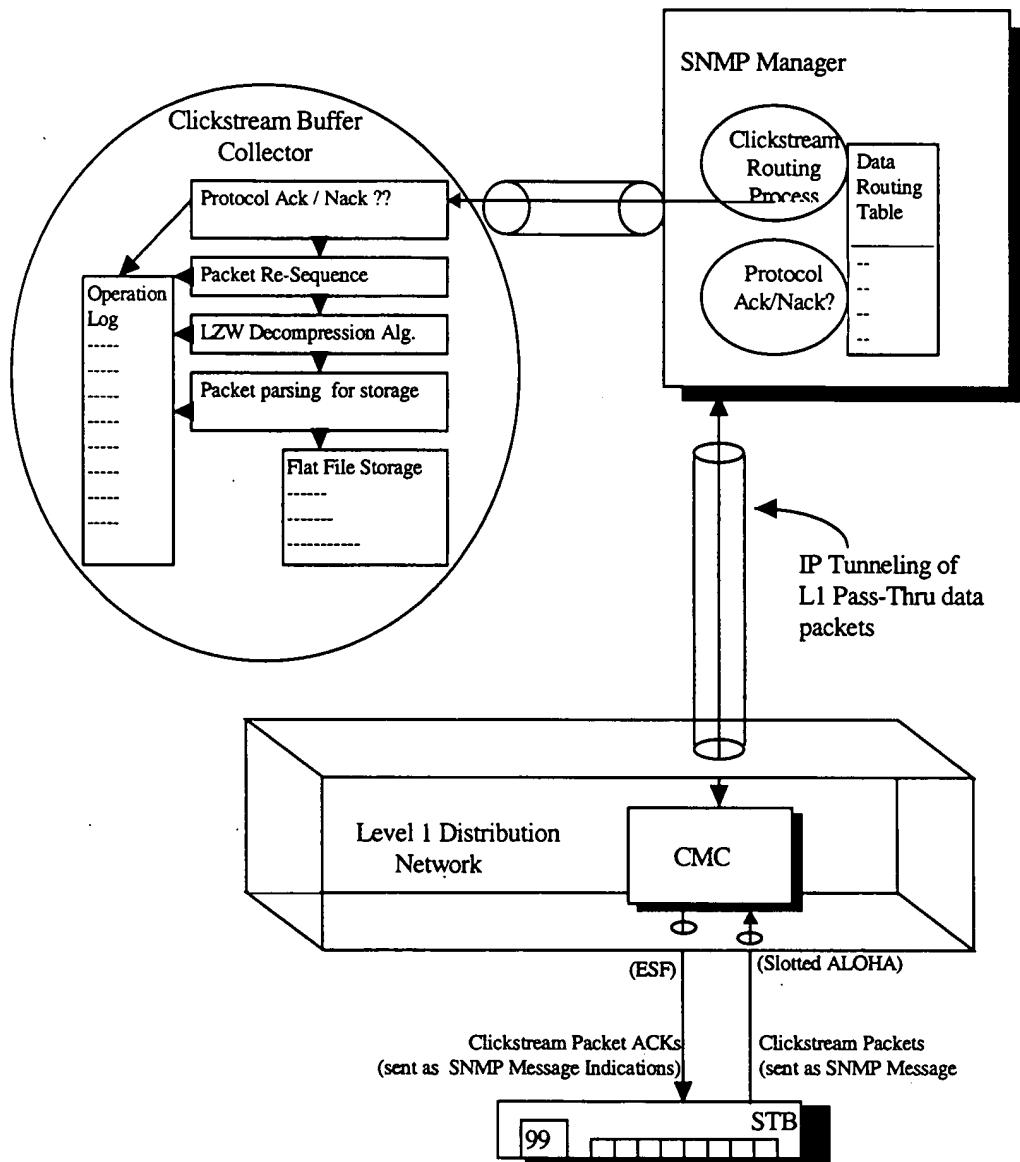
Start the 4hr.replay replay script on each of the two remotes. Make sure they are setup to use the direct ethernet connection. Monitor system looking for obvious problems.

After the replay, launch the Navigate and an ITV session.

**Results:**

- 1) Compare that all buffers uploaded successfully.
- 2) Note any STB or CMC lock ups.
- 3) Did navigator launch?





**Figure 1: Clickstream Upload Data Flow Elements**

Network Elements being tested:

- 1) Clickstream Kernel
- 2) Surfer Application
- 3) Set-Top SNMP Agent
- 4) Clickstream Collector
- 5) Clickstream Controller
- 6) CMC
- 7) Slotted-Aloha Demodulator
- 8) ESF Modulator